Physics of Ultra-Small Structures

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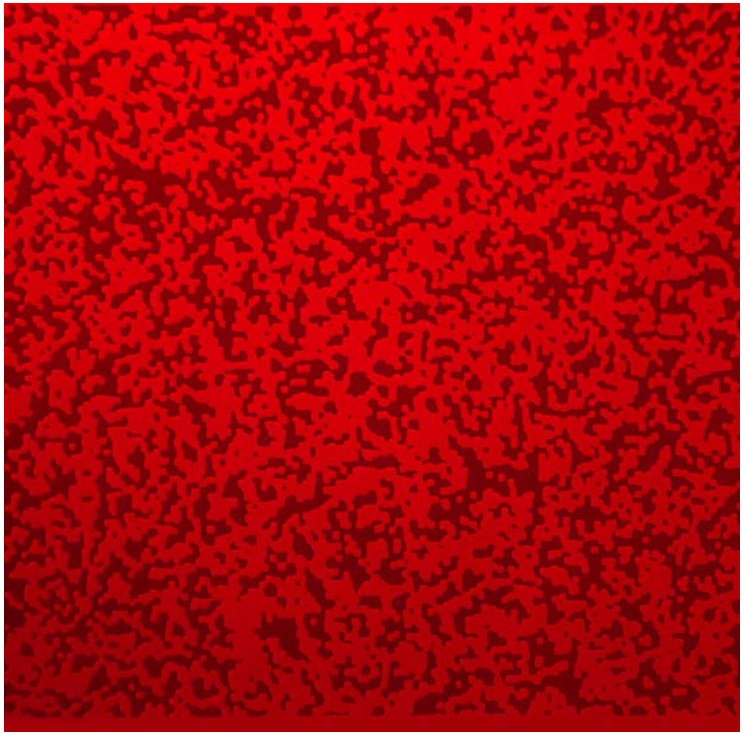
We have studied how fluids flow through randomly structured small scale geometries. This structure is filled with decane (the bright red regions) - the dark regions are inaccessible to the fluid (i.e., solid).

One goal is to understand multiphase flow; i.e., the behavior when two or more phases (such as a liquid and a gas) are present simultaneously.



600 μm

(flow channels are 1 μm tall)

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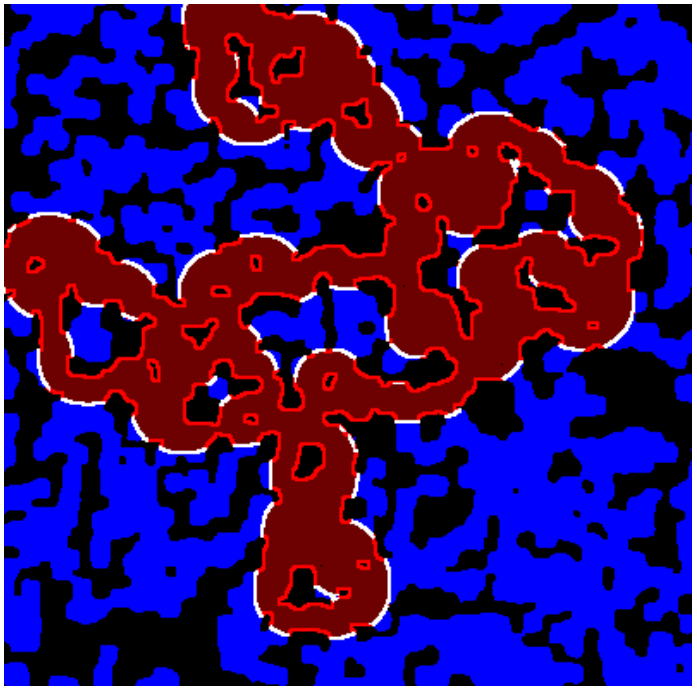
This sample contains a liquid that is being expelled by a gas. The area and curvature of the liquid-gas interface play a crucial role in determining the behavior.



black - solid **maroon - nitrogen gas**
blue - decane **white - interface**

Broader impact: This problem has implications for understanding the flow of groundwater through porous soil, and oil through porous rock.

Education: This work was started by Greg Fiete and Mathew Dorbin as undergraduate reseach projects (Greg just obtained his Ph.D. at Harvard). It was then continued as the Ph.D. thesis work of Jiangtao Cheng.